

A banner image at the top of the slide featuring a satellite map of the Pacific Ocean with a color-coded salinity overlay. Overlaid on the map are a research ship, a red and white buoy, and a yellow autonomous underwater vehicle (AUV).

**SPURS**

Salinity Processes in the Upper ocean Regional Study

# SPURS, SALINITY AND THE GLOBAL WATER CYCLE

Ray Schmitt

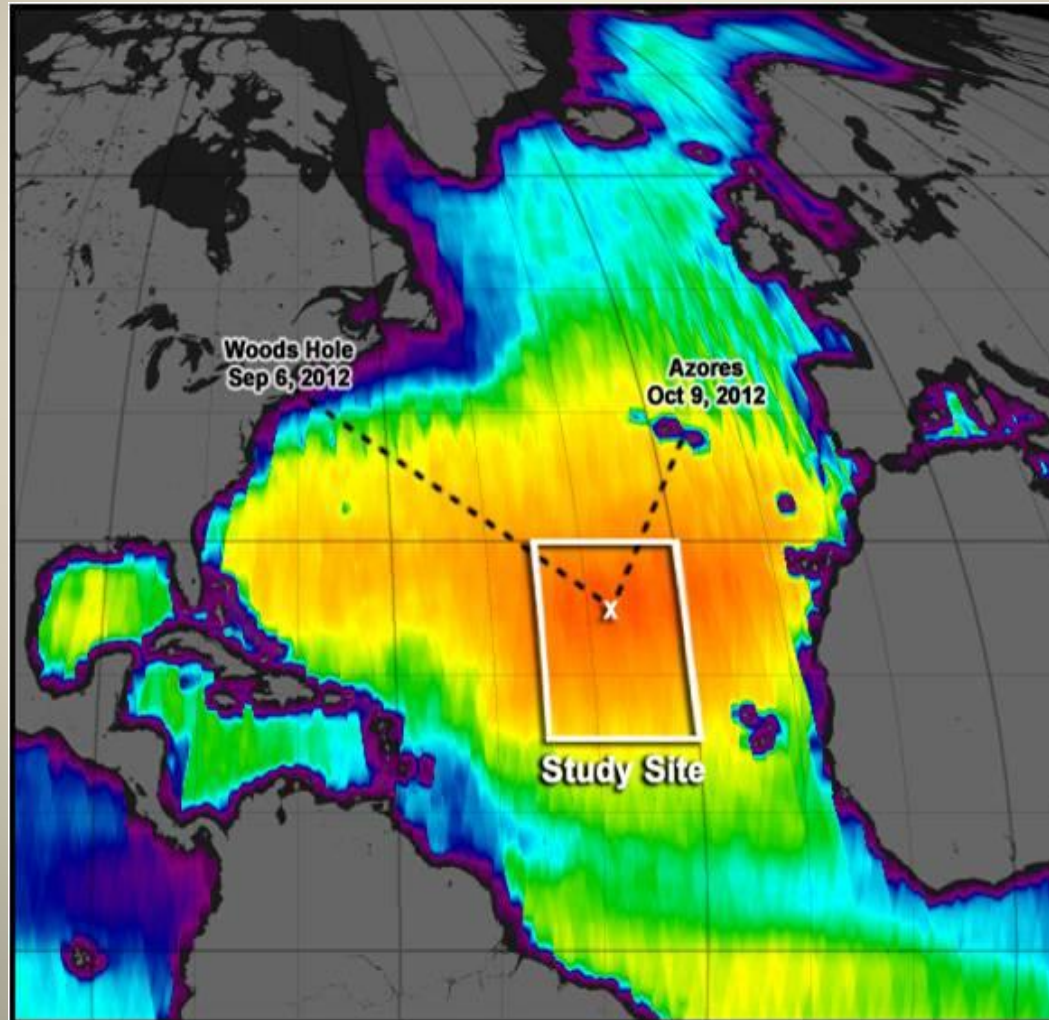
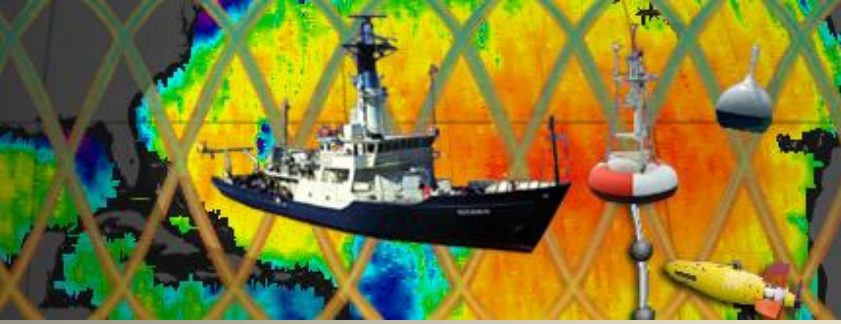
Woods Hole Oceanographic Institution

*Woods Hole Oceanographic Institution, 5 September 2012*



# SPURS

Salinity Processes in the Upper ocean Regional Study





# Extreme Drought And Flooding On The Rise



Texas 2011

2010 and 2011: wettest years on record.  
2012: hottest and driest?

Will the extreme weather continue?

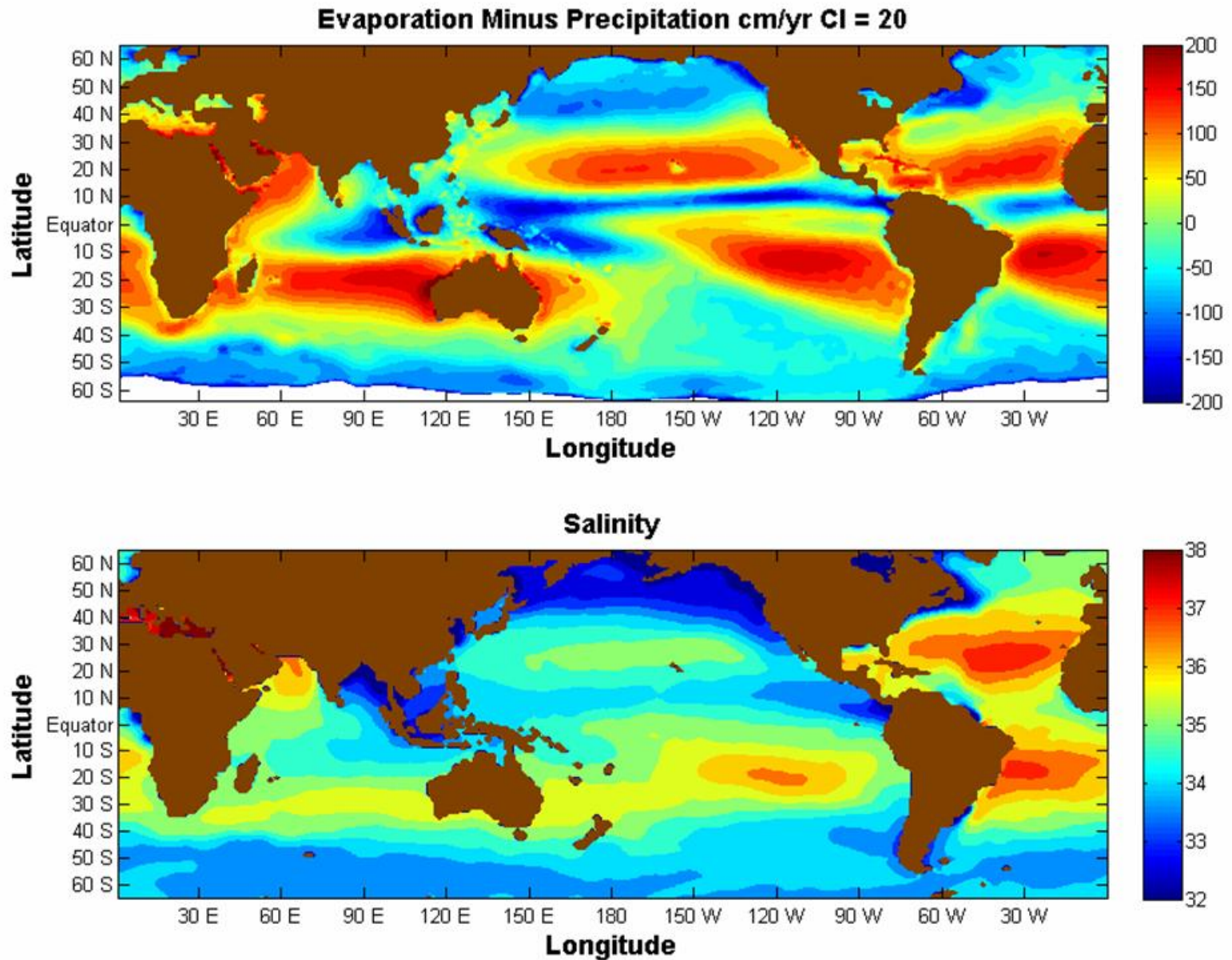
Key question for climate change: how much will the water cycle intensify?

The oceans may hold the answer.



New York 2011

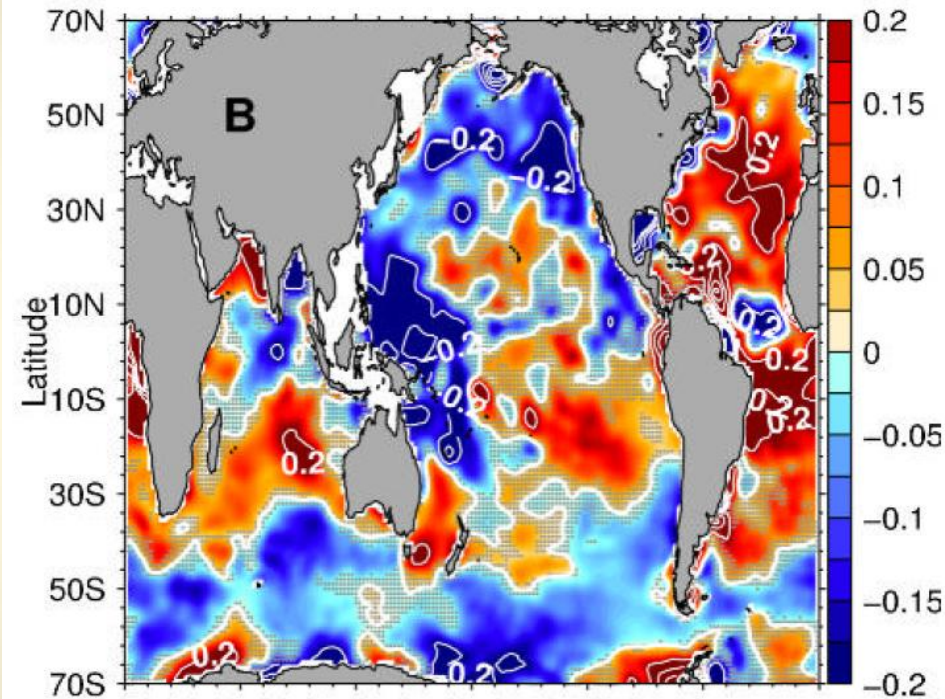
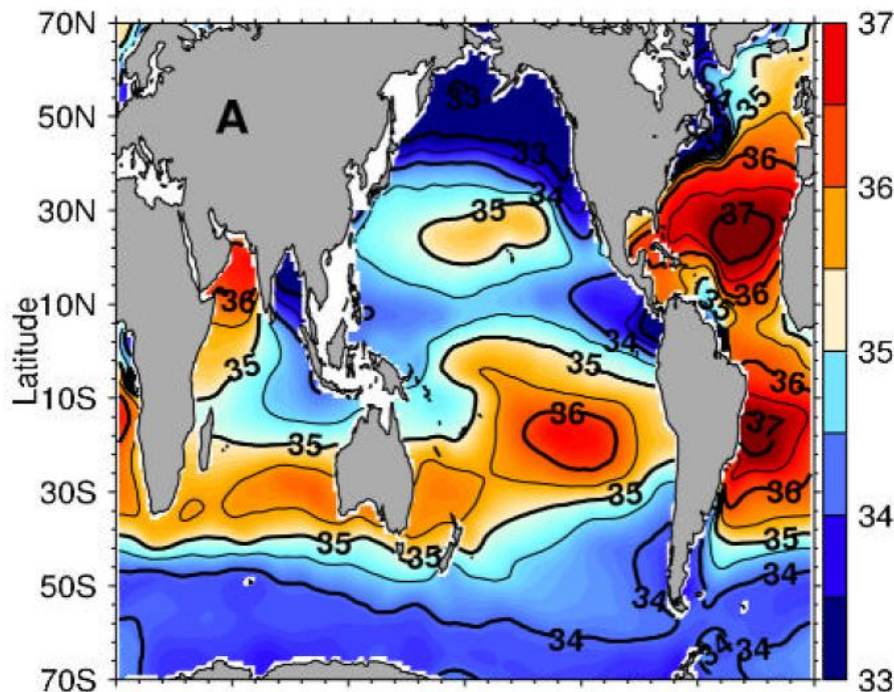
# Salinity And The Global Water Cycle





## Mean surface salinity

## 50-year trend in salinity

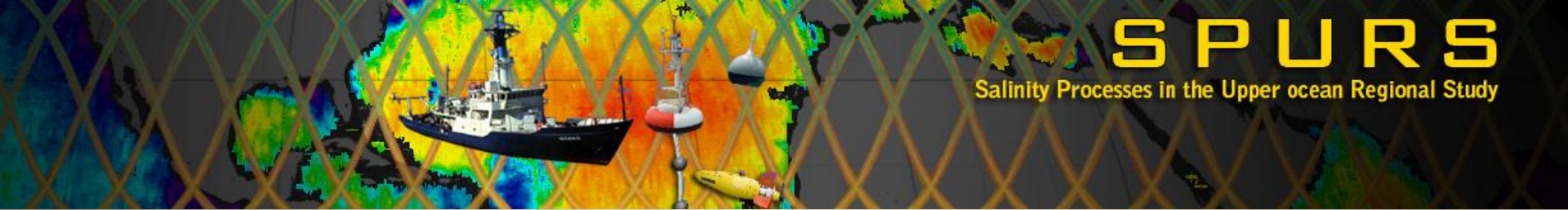


Salty areas are getting saltier, fresh areas are getting fresher, indicating a strong intensification of the water cycle.

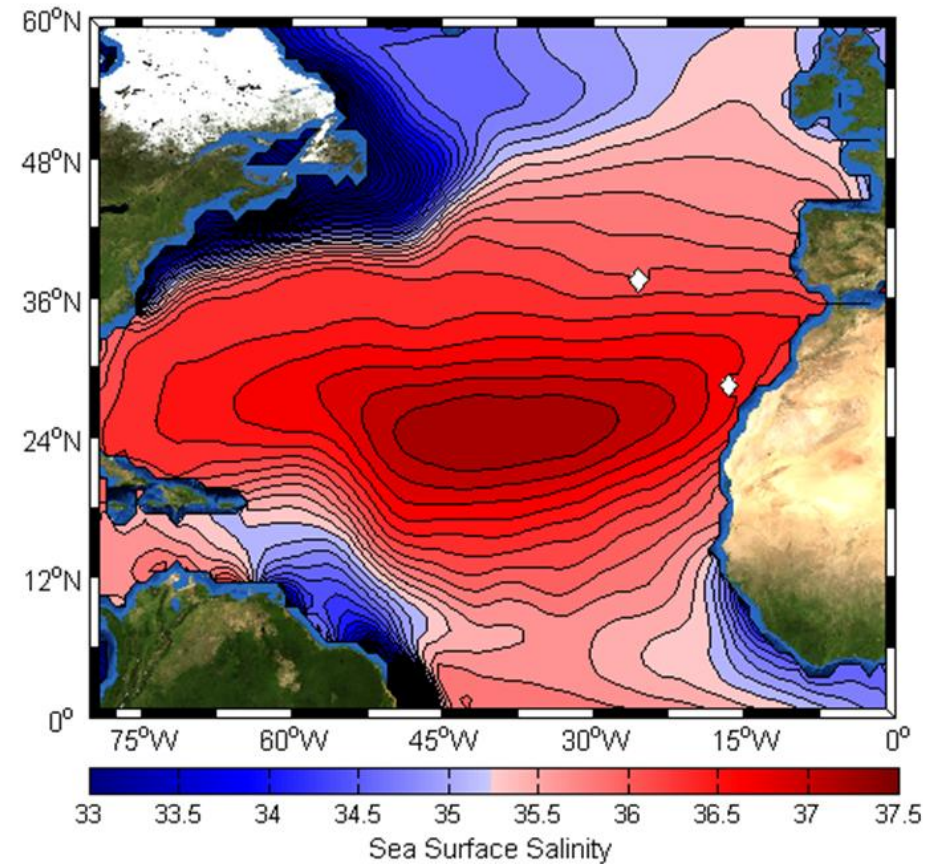
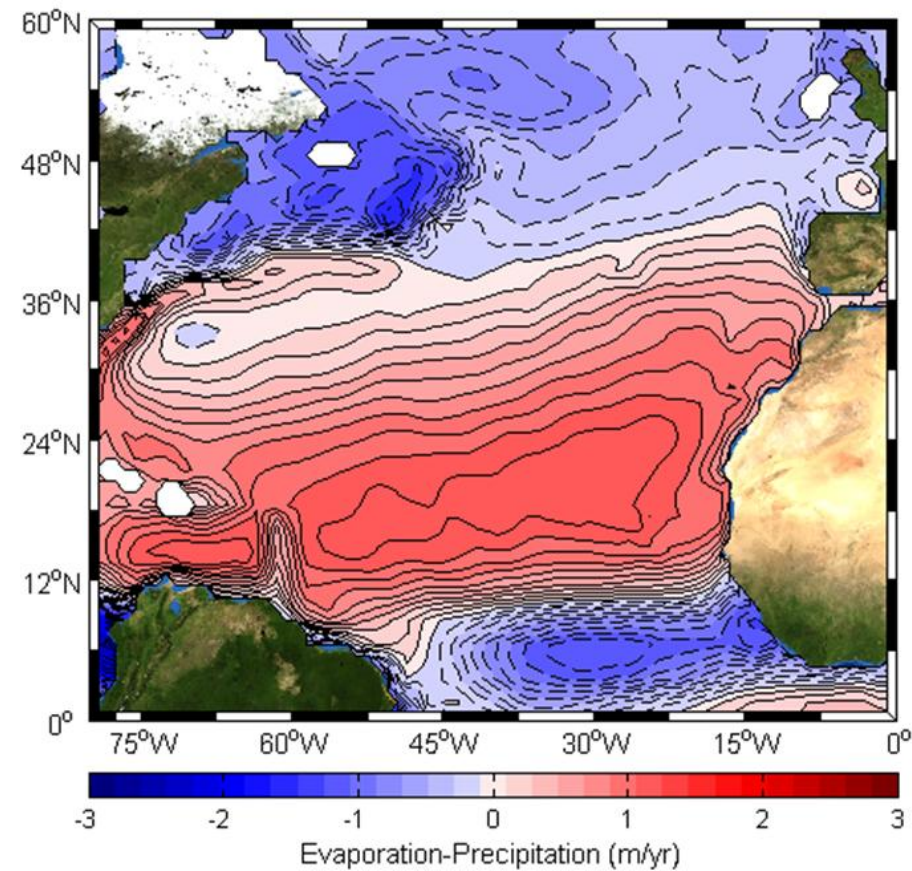
*Durack and Wijffels, 2010. Journal of Climate*

*Durack, Wijffels and Mercer, 2012. Science*

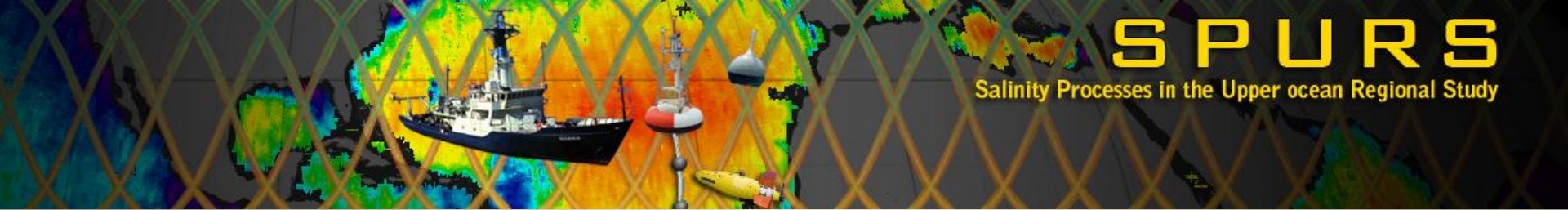




N. Atlantic evaporation-precipitation and salinity are highly correlated.



**Note: the E-P zero line is close to vegetation/dry land boundary in Africa**



# SPURS Science Summary:

- Salinity appears to be a very sensitive indicator of change in the water cycle.
- Salinity trends indicate water cycle intensification is much greater than models can explain.
- To understand these trends, oceanographers have to determine how ocean processes (mixing, advection) are responding to warming, changing winds, and water cycle intensification. SPURS will address such physics on time scales from a day to a year.
- Our challenge is to determine how the salinity maximum is maintained. We wish to identify any oceanic mechanisms that could amplify the salinity response to changing evaporation.





# SPURS IN-SITU MEASUREMENTS

Dave Fratantoni  
Woods Hole Oceanographic Institution

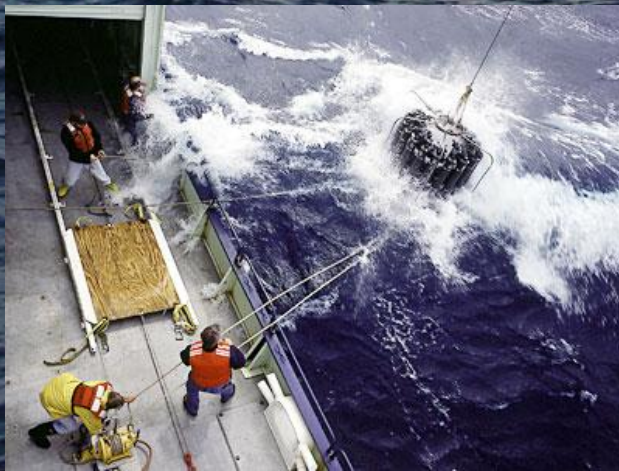
*Woods Hole Oceanographic Institution, 5 September 2012*



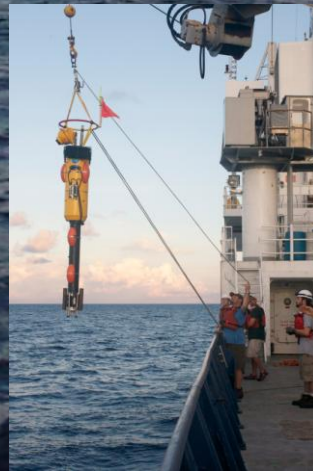


# Ship-based measurements

Wind speed and direction  
Air and sea temperature  
Surface temperature and salinity  
Ocean currents



CTD rosette



Microstructure Profiler

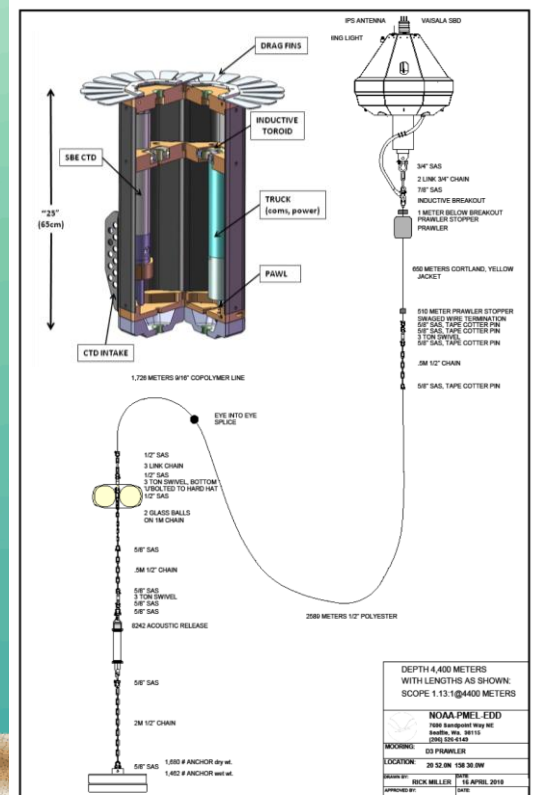
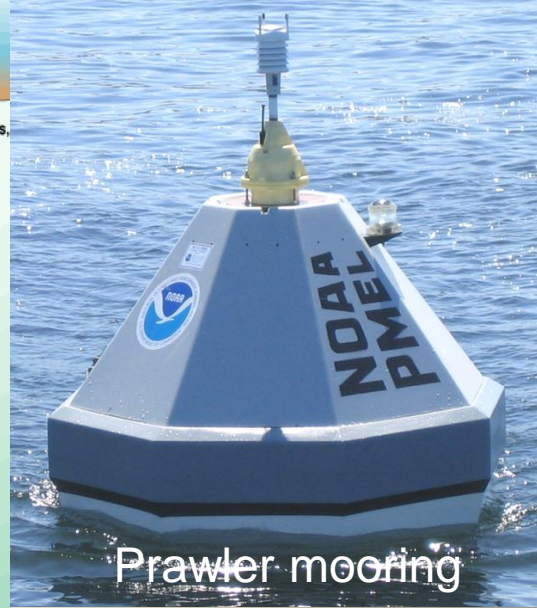
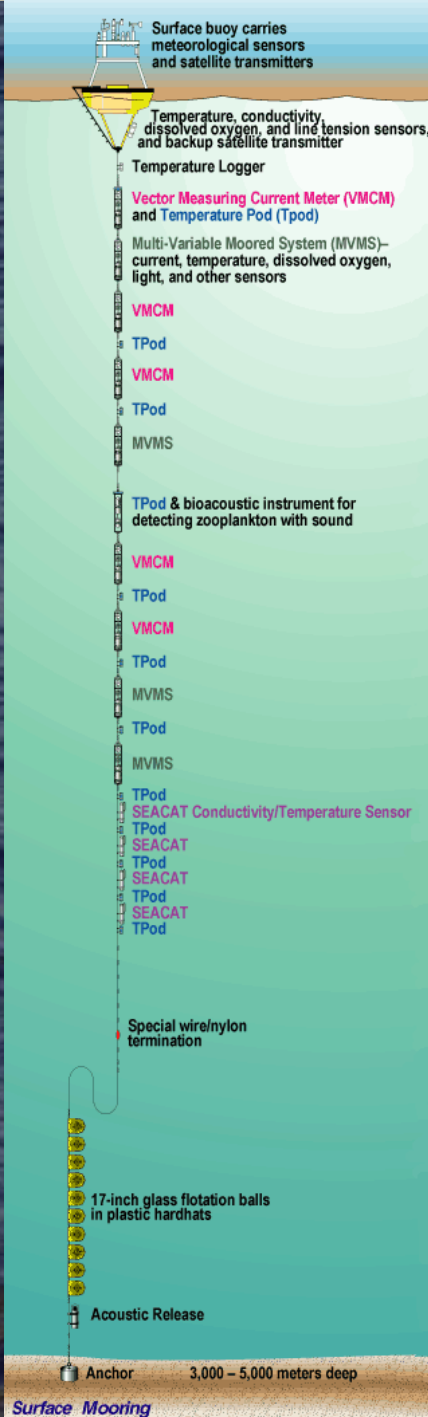


Underway CTD



## A yellow and white moored oceanographic observation buoy, labeled K-3, with a NASA logo and various scientific instruments mounted on top. The buoy is floating on the ocean surface. The yellow upper section has the text 'K-3' and 'NASA' on it. The white lower section has a depth scale with markings for 50, 60, and 70 meters. The top of the buoy is equipped with a complex array of instruments, including a white frame with various sensors and a large white cylindrical tank.

## Surface flux mooring





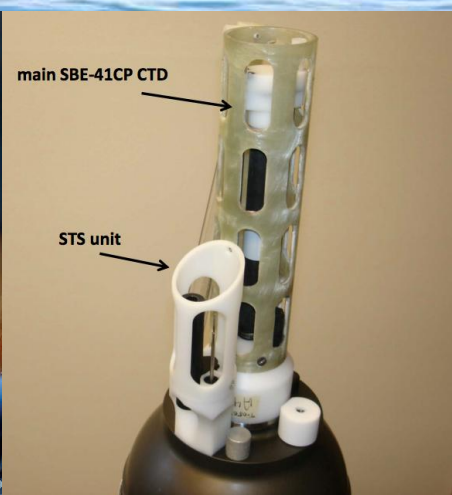
# Drifting Instruments



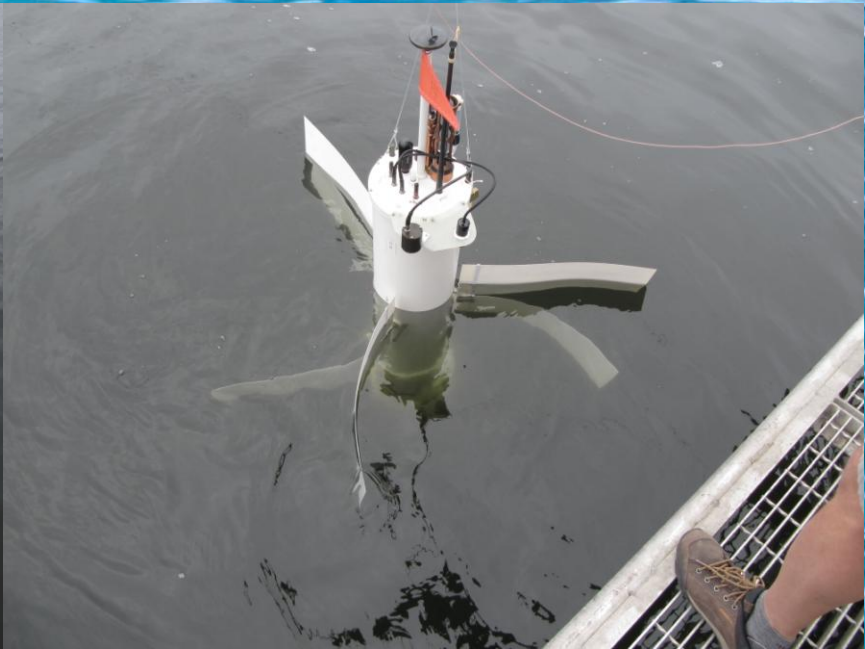
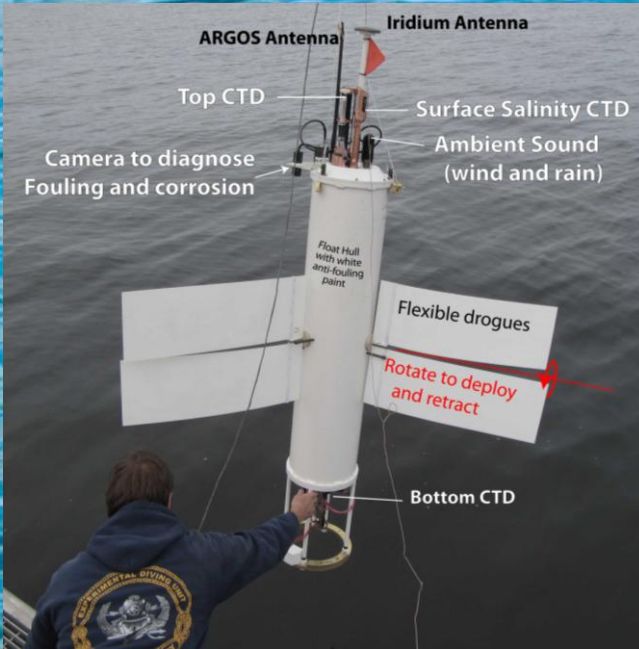
Surface drifter



Photo: Alicia Navidad, CSIRO



Profiling float



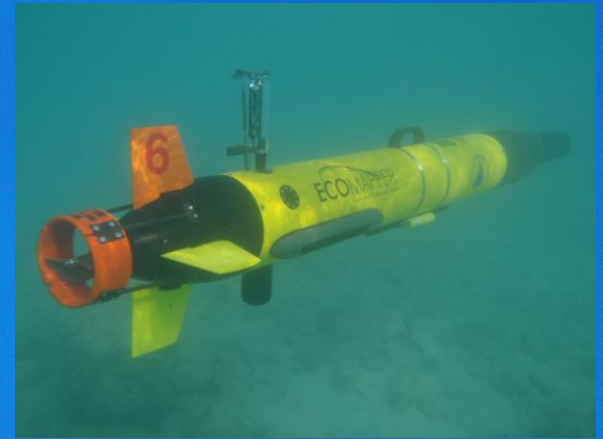
Lagrangian drifter



# Autonomous Underwater Vehicles (AUVs)



Slocum Glider



IVER2/Ecomapper



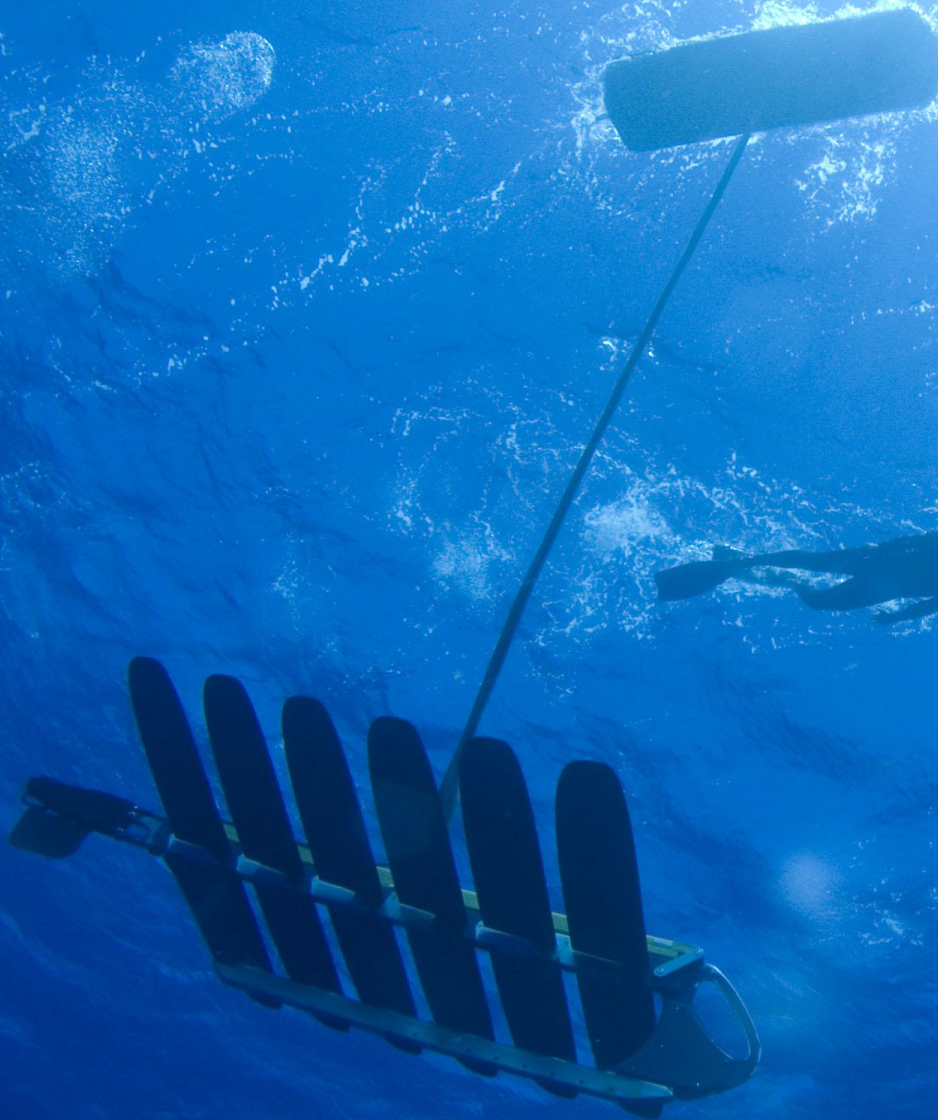
Seaglider



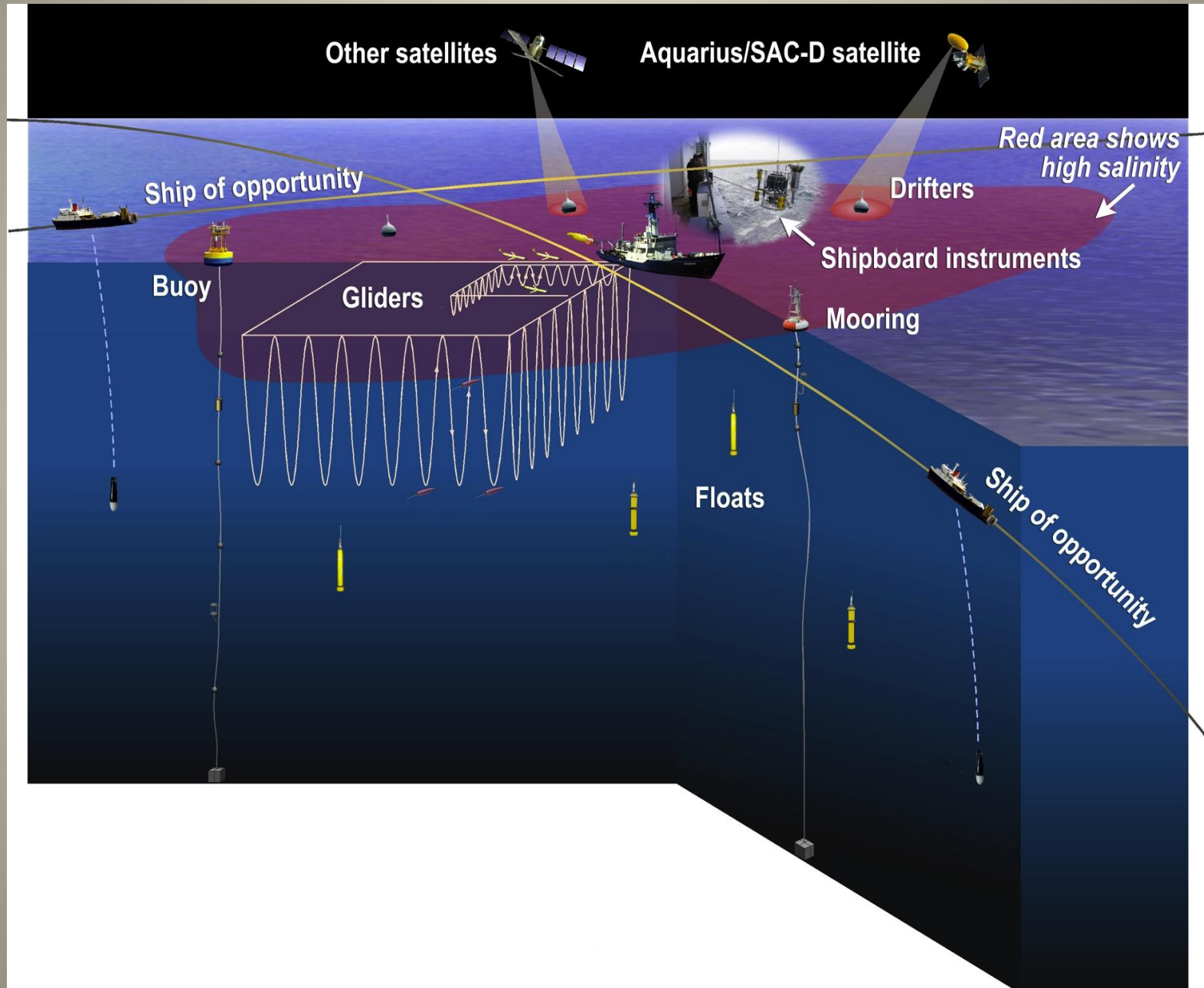
# *Autonomous Surface Vehicles*



Wave Glider



# Nested Sampling Strategy





# INTEGRATION OF SATELLITE, IN SITU AND MODEL DATA

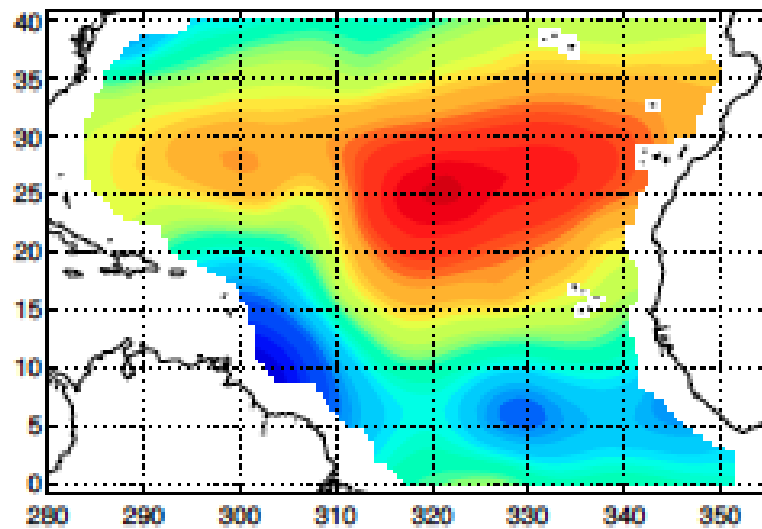
Eric Lindstrom  
NASA

*Woods Hole Oceanographic Institution, 5 September 2012*

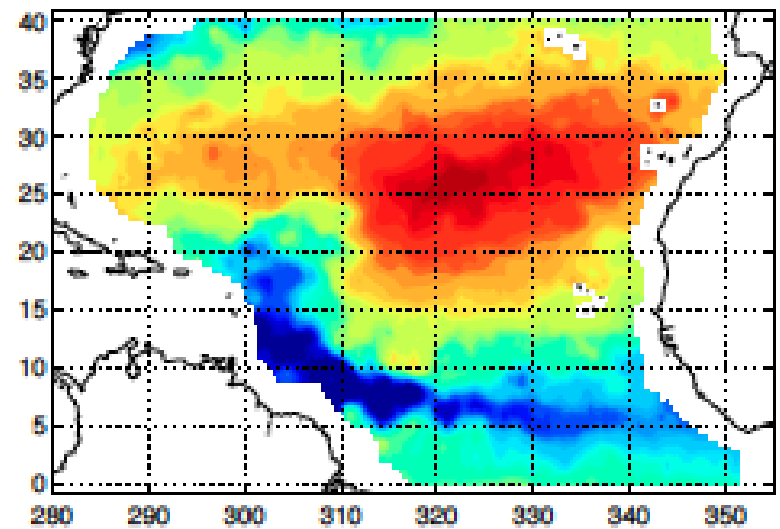


Argo

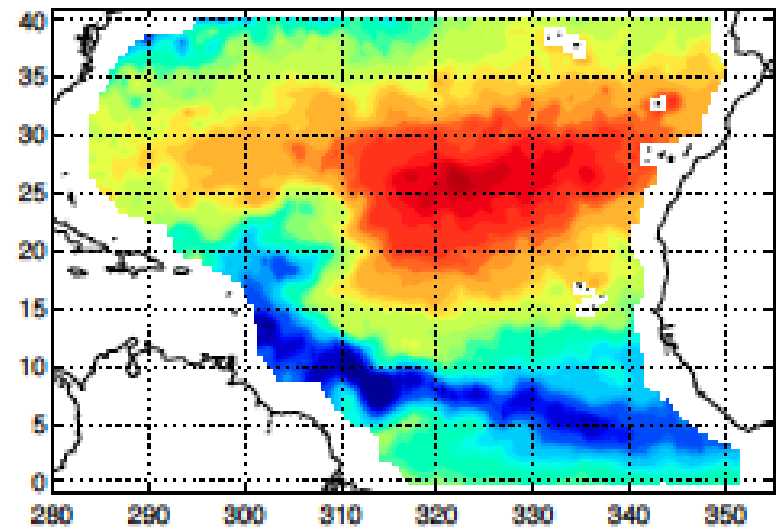
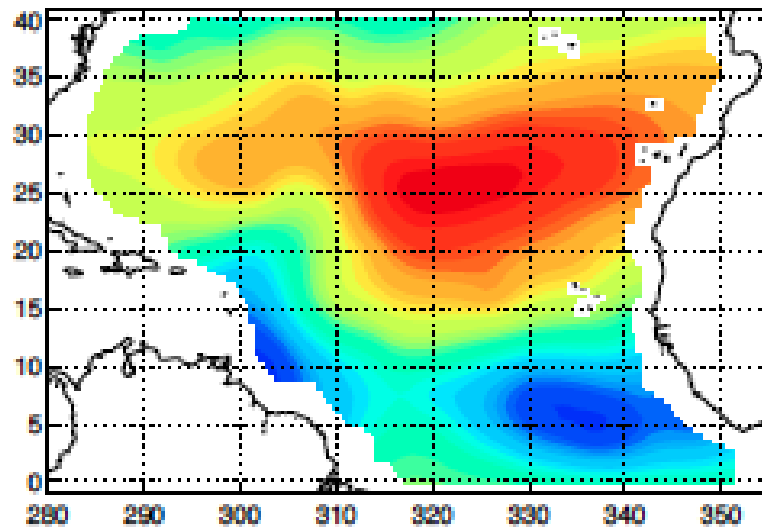
September 2011



Aquarius



October 2011

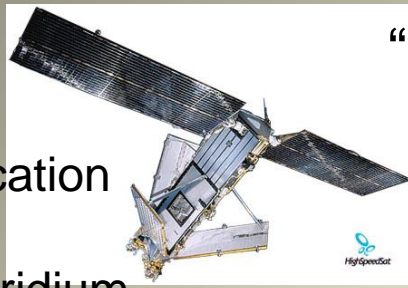




## “Wet Side”

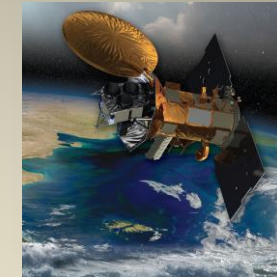
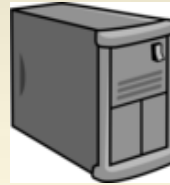
## “Dry Side”

Communication  
Satellite  
Argos or Iridium



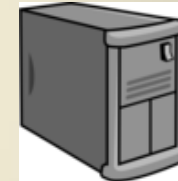
WMO Global  
Telecomm  
System

Individual Lab  
Servers

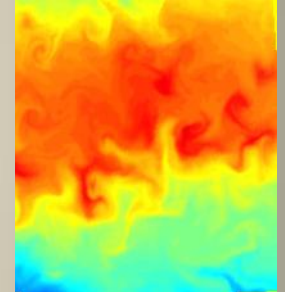


Aquarius  
and other  
satellite  
data (SST,  
ASCAT, etc.)

Satellite  
Data Server  
At JPL



Ocean Model



WaveGlider



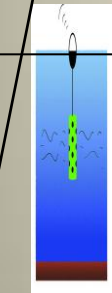
Flux  
Mooring



Prawler  
Mooring

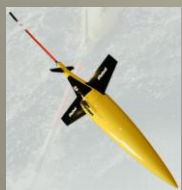
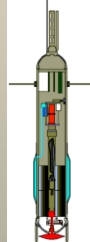


Ship-based  
instruments



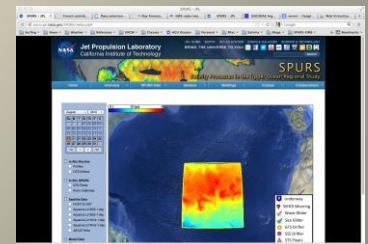
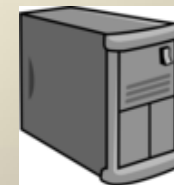
Surface  
Drifter

Argo  
Float



SeaGlider

SPURS Data  
Server



SPURS Web page